The pupils continued fully dilated, the iris being reduced to an almost imperceptible circle, the dilatation exceeding that which I have been able to attain even with atropia. I will not dwell more fully at present on this last interesting fact, which is opposed to what we generally meet with in the administration of morphia. Twelve hours after, pupils normal, animal quite well.

Strychnia and Chloroform.—After three minutes' immersion of foot, dilatation of pupils ensued. After five minutes, the immersed limb was very sensitive, apparently more so than normal. Limb removed from solution: spasms about the throat now appeared, which were rapidly succeeded by stiffness of the trunk, increasing into tetanic spasms. Death, two minutes after removal.

Strychnia and Alcohol.—Foot immersed in a solution of alcohol and strychnia for upwards of thirty-five minutes; no symptoms of strychnine poisoning. Removed from solution and washed. Twelve hours later, no dilatation nor contraction of pupils.

The above observations evidently show that medicinal substances may be very rapidly absorbed into the circulation under certain circumstances, among which, the most important is the choice of the menstruum in which they are dissolved.

It remains for us to examine into the effect of temperature, inflammation, neuro-vascular paralysis, &c., on absorption. But, what is of still more importance, we have to see how far these facts are applicable to man in health and disease.

Meanwhile, I take this opportunity to state that a remarkable uniformity exists between cutaneous absorption in man and in the lower animals, and I believe that the application of these facts to practical medicine promises to be very important and extensive.

VII. "On Spontaneous Evaporation." By Benjamin Guy Babington, M.D., F.R.S., &c. Received June 7, 1859.

(Abstract.)

The object of this communication is to make known certain powers of attraction and repulsion, hitherto, as far as I know, unnoticed, which are possessed by soluble substances in relation to their solvent, and which, in the case of water (the solvent here considered), are measured by the amount of loss, on spontaneous evaporation, in the

weight of solutions of different salts and other substances, as compared with the loss of weight in water.

The force which holds together the particles of a vaporizable liquid is gradually overcome, if that liquid be exposed to air, by another force which separates, expands, and diffuses those particles in the form of vapour; and this separation takes place, even at a common temperature, so rapidly, provided the surface be sufficiently extensive, that an easy opportunity is afforded of determining the loss of weight by a common balance.

A subject for investigation, possessing much interest, thus presents itself, and, in its pursuit, some new and unexpected results are encountered.

The method which I have pursued has been to expose to the atmosphere, for a definite period, solutions of different salts, and also pure water under like conditions of quantity and area, temperature, atmospheric moisture, and atmospheric pressure.

Different salts and other soluble substances are thus found to possess, when in solution, different powers of retarding or accelerating evaporation, and hence, from its amount, as compared with that which takes place in pure water, we can estimate the comparative value of those powers.

The powers themselves being established as facts, the next point is to endeavour to discover the cause or causes on which they depend, and a wide field of inquiry is thus opened.

The following are the instruments which have been employed :—

1. A balance, for one of the scales of which is substituted a flat metal plate, six inches square, on which the vessels to be weighed can be conveniently supported. This balance will turn sensibly at a grain, even with a weight of 4 lbs. on either side.

2. A number of copper pans tinned within, all of the same size, being precisely 5 inches square inside, with perpendicular sides $\frac{3}{4}$ths of an inch in height, also a number of earthenware pans of the same dimensions, The area of 25 square inches has been chosen, partly because this size is convenient for manipulation, and partly because the results obtained can be easily represented in decimals. This facility of decimal calculation would be of importance should such pans come into general use as hygrometers, for which purpose they are well adapted.

3. Specific gravity bottles and counterpoises.

4. Thermometers of various degrees of delicacy and range, for ascertaining freezing, temperate, and boiling points.

5. Test tubes for use, in connexion with these thermometers, as well in freezing mixtures as over the spirit lamp.

6. A barometer.

7. Various salts and other soluble substances, furnishing, when in solution, the materials for examination.

The mode of procedure which I have adopted has been, to state my facts in the form of propositions, and to prove each of these propositions by experiments.

The propositions are as follows:—

1st proposition.—That in many aqueous solutions of salts and other soluble substances evaporation is retarded, as compared with the evaporation of water.

2nd proposition.—That in solutions of salts which retard evaporation, that retardation is in proportion to the quantity of the salt held in solution.

3rd proposition.—That different salts and other substances soluble in water have different degrees of power in retarding its evaporation.

4th proposition.—That the power of retarding evaporation does not depend on the specific gravity of a solution.

5th proposition.—That in aqueous solutions of salts, the power of retardation does not depend on the base, whether we compare solutions containing like weights of the salt, or solutions of like specific gravities.

6th proposition.—That in aqueous solutions of salts, the power of retarding evaporation does appear to depend upon the salt radical or acid, although the retardation is not altogether independent of the influence of the base.

7th proposition.—That salts with two equivalents of an acid have a greater power of retarding evaporation than salts with one equivalent. There are, however, exceptions.

8th proposition.—That there are some salts which, being dissolved in water, do not retard its evaporation, and some salts which, so far from retarding, actually accelerate evaporation.

The truth or probability of the foregoing propositions is established by numerous experiments, but in this abstract I shall, for the sake

of brevity, only state the result of one or two experiments in proof of each.

The first proposition is proved by the fact that a solution of hydrochlorate of soda in the proportion of 480 grains to four measured ounces of water, when exposed under the conditions already stated to spontaneous evaporation, lost only 33 grains in weight after twelve hours' exposure,—while four ounces by measure of water lost 53 grains,—and after twelve hours' further exposure lost only 109 grains, while the water lost 174 grains; that is, the water, as compared with the solution, lost weight in the ratio nearly of 5 to 3.

The second proposition is proved by the fact that a solution of 240 grains of hydrochlorate of soda in four ounces by measure of water lost in twelve hours 73 grains by evaporation, while four ounces by measure of pure water lost 81 grains,—this is in a proportion of only about 8 of the latter to 7 of the former; whereas, when double the quantity or 480 grains of salt were dissolved, the pure water, as compared with the solution, lost in the proportion of 5 to 3.

The third proposition is proved by the fact that a solution of 480 grains of nitrate of potassa in 4 ounces or 1920 grains of water lost in twelve hours 95 grains; while a solution of the same strength of hydrochlorate of soda lost only 70 grains; and again, a solution of loaf-sugar, in which 480 grains were dissolved in 1920 grains of water, lost in 20 hours 175 grains, while a like solution of hydrochlorate of soda lost only 117 grains.

The fourth proposition is proved by the fact that 480 grains of gum-arabic dissolved in 1920 of water had a specific gravity of 1·072, while a solution of hydrochlorate of soda of like strength had a specific gravity of 1·149; after $11\frac{1}{4}$ hours, the former had lost by evaporation 71 grains, while the latter had lost only 50 grains. Here, therefore, the solution of the lighter specific gravity was *less* retarded in its evaporation than the heavier solution. In contrast with this fact, a solution of hydrochlorate of ammonia of 480 grains to 1920 grains of water, having a specific gravity of only 1·060, lost by evaporation, in 8 hours and 44 minutes, 17 grains, while a like solution of hydrochlorate of soda lost 24 grains. Here, then, the solution of lighter specific gravity was *more* retarded in its evaporation than the heavier solution. The conclusion is decisive that specific gravity has no necessary connexion with the phænomena.

The fifth proposition is proved by the fact that in the following solutions of salts of potassa, all of the same strength (namely 1 salt to 10 water), a difference in the amount of evaporation in each will be observed to have taken place, and it must be borne in mind that in solutions so weak we cannot expect that difference to be very great.

The reason for employing weak solutions was the necessity for having all of the same strength, one in ten being the extent, to which the least soluble salt submitted to examination, namely, the sulphate of potassa, will, at a low temperature, dissolve.

	grains.
Acetate of potassa lost in 35 hours	145
Bicarbonate of potassa lost in 35 hours . . .	131
Carbonate of potassa lost in 35 hours . . .	115
Ferro-cyanate of potassa lost in 35 hours . .	110
Hydrochlorate of potassa lost in 35 hours . .	98
Nitrate of potassa lost in 35 hours	117
Sulphate of potassa lost in 35 hours	132
Tartrate of potassa lost in 35 hours	151

The above solutions were next made all of one specific gravity, namely 1·060, temp. 62° Fahr., instead of being all of one strength, and the following is the result:—

	grains.
Acetate of potassa lost in 16½ hours	46
Bicarbonate of potassa lost in 16½ hours . . .	45
Carbonate of potassa lost in 16½ hours . . .	35
Ferro-cyanate of potassa lost in 16½ hours . .	41
Hydrochlorate of potassa lost in 16½ hours . .	32
Nitrate of potassa lost in 16½ hours	39
Sulphate of potassa lost in 16½ hours	42
Tartrate of potassa lost in 16½ hours	43

The sixth proposition is rendered probable by the following experiment, in which solutions are employed of acetic, nitric, sulphuric, and hydrochloric acids, combined respectively with potassa, soda, and ammonia, in the proportion of 100 grains of the salt to 1000 grains of water. After the expiration of 10 hours and 20 minutes, the solution of the three acetates lost respectively, for the potassa salt 35 grs., for the soda salt 35 grs., and for the ammonia salt 28 grs. In the solutions of the three nitrates, the loss was respectively 24, 25 and 25. In the solutions of the three sulphates,

the loss was 30 grs., 37 grs., and 29 grs. respectively, while in the solutions of the hydrochlorates it was 17, 18, and 19 grains.

The seventh proposition is proved by an experiment in which a solution of 100 grains of carbonate of potassa dissolved in 1000 grains of water is compared with a like solution of bicarbonate of potassa. In ten hours the solution of the carbonate lost 45 grains, while that of the bicarbonate lost only 36 grains. In comparing like proportions and quantities of sulphate and bisulphate of potassa, the respective losses in 13 hours were, for the former 53 grains, for the latter 45 grains. Similar comparisons of the acetate and bin-acetate of ammonia, phosphate and biphosphate, sulphate and bisulphate of potassa, tartrate and bitartrate of soda show like results. In the course of investigating this proposition it was remarked incidentally that in all the salts examined, with the single exception of carbonate and bicarbonate of soda, the bin-acid solution (the proportion by weight of salt to water being equal) is of less specific gravity than the mono-acid solution, though possessing a greater power of retarding evaporation.

The eighth proposition, which seems extraordinary and even paradoxical, is proved by an experiment in which *saturated* solutions of—1, ferro-cyanate of potassa, 2, bitartrate of potassa, 3, sulphate of copper, 4, chlorate of potassa, and 5, distilled water, were compared. In 9 hours and 20 minutes, their losses by evaporation were respectively 34 grs., 38 grs., 34 grs., 29 grs., and 29 grs., where we perceive that in the chlorate of potassa solution there has occurred no retardation at all, while in the following experiment, in which 120 grains of each of the salts examined were dissolved in 1200 grains of water, namely,—1, solution of sulphate of copper, 2, solution of ferro-cyanate of potassa, 3, solution of carbonate of soda, and 4, distilled water, the number of grains lost by evaporation after $15\frac{1}{2}$ hours' exposure were,—1, 120 grs.; 2, 113 grs.; 3, 106 grs.; 4, 103 grs.

It is thus perceived that in all the three solutions a more rapid evaporation had taken place than in distilled water alone.

One or two other propositions are in process of investigation.

The paper concludes with a table of the freezing-points, boiling-points, and specific gravities, as well of weak as of saturated solutions, of the salts which have been submitted to examination.